Improving EMT Learning Using a 3-D Virtual PC-Based Training Simulator

Eileen A. Hemman, EdD., RN,BC

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Study Funded by:Telemedicine and Advanced Technology Research Center

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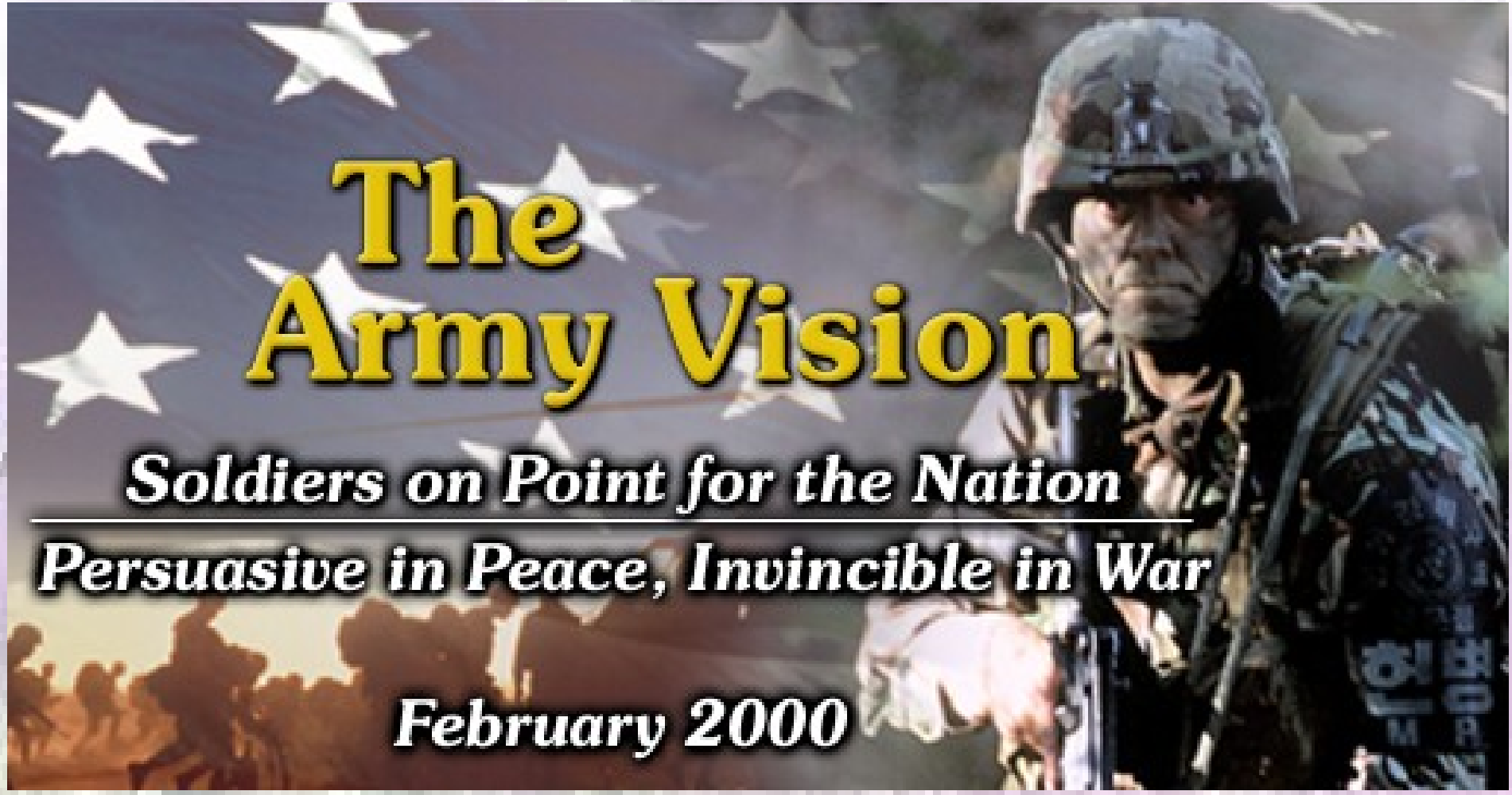

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- Combat-ready brigade- 96 hours
- A full division - 120 hours
- 5 divisions - 30 days

A New Kind of Combat Medic (91W)

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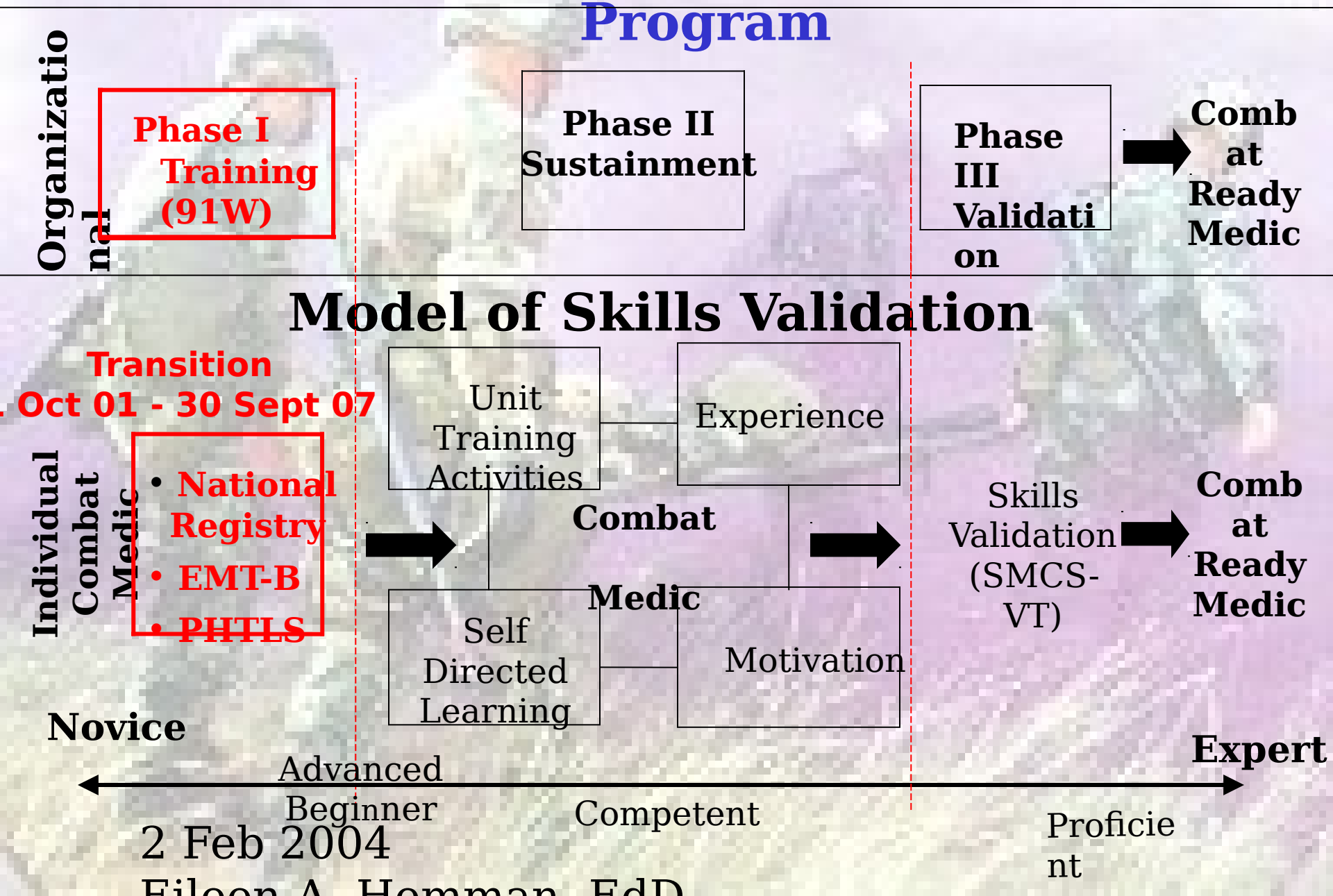
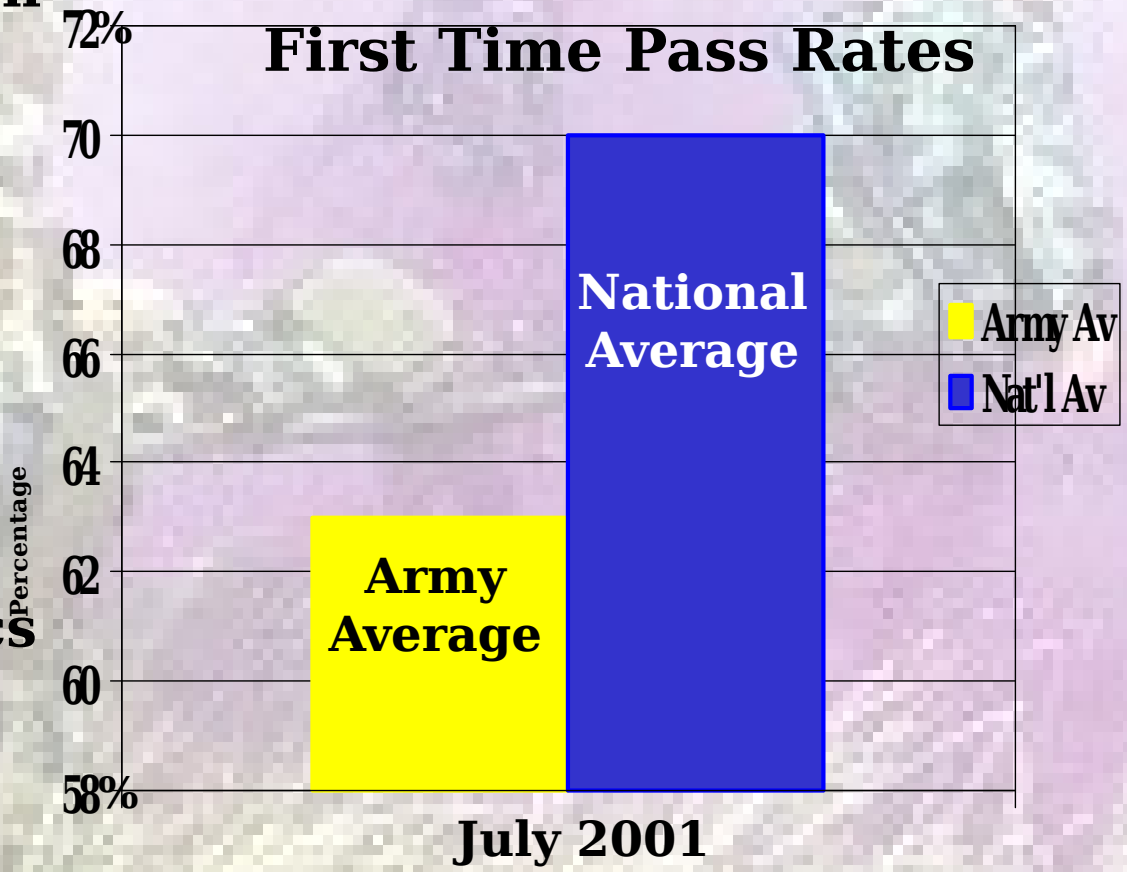
Army Management Training Program



The Problem

- **NREMT Certification requirement for all transitioning 91W**
- **Large class sizes**
- **Limited resources**
- **First time NREMT pass rates for transitioning medics**



Purpose: **Validate the use of technology as a training strategy**

Hypothesis: **Participants experiencing standard EMT training supplemented by STATCare will have an increase in:**

- ✓ **NEMT scores**
- ✓ **NREMT pass rates &**
- ✓ **Demonstrate cost-effectiveness**

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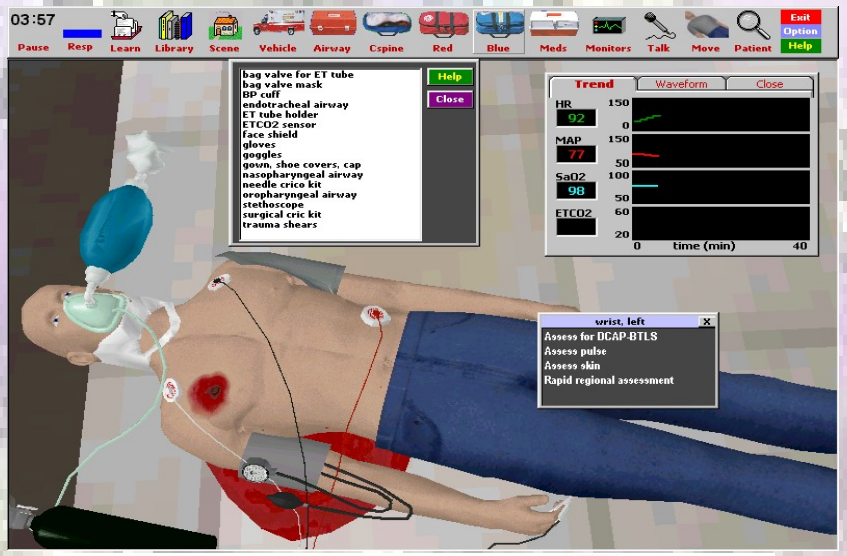
THE Mercury

Simulation Technologies for Advanced Trauma Care



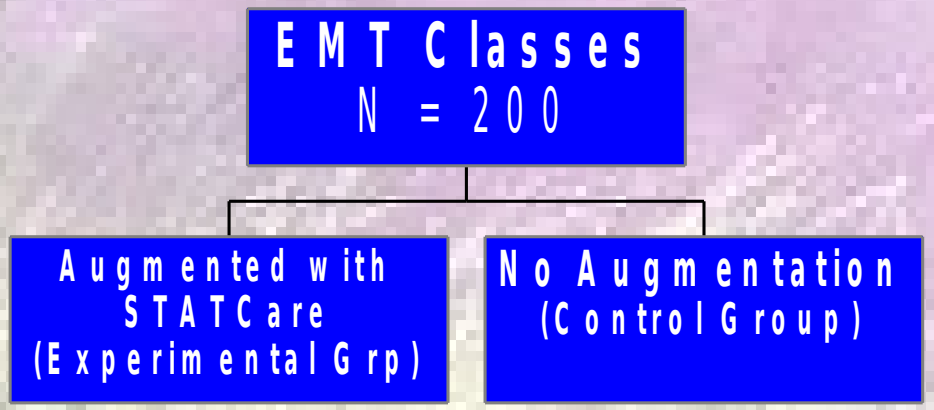
- Technology as an instruction multiplier
- Software developed as dual funded project by MMRC and RTI

Virtual EMS™

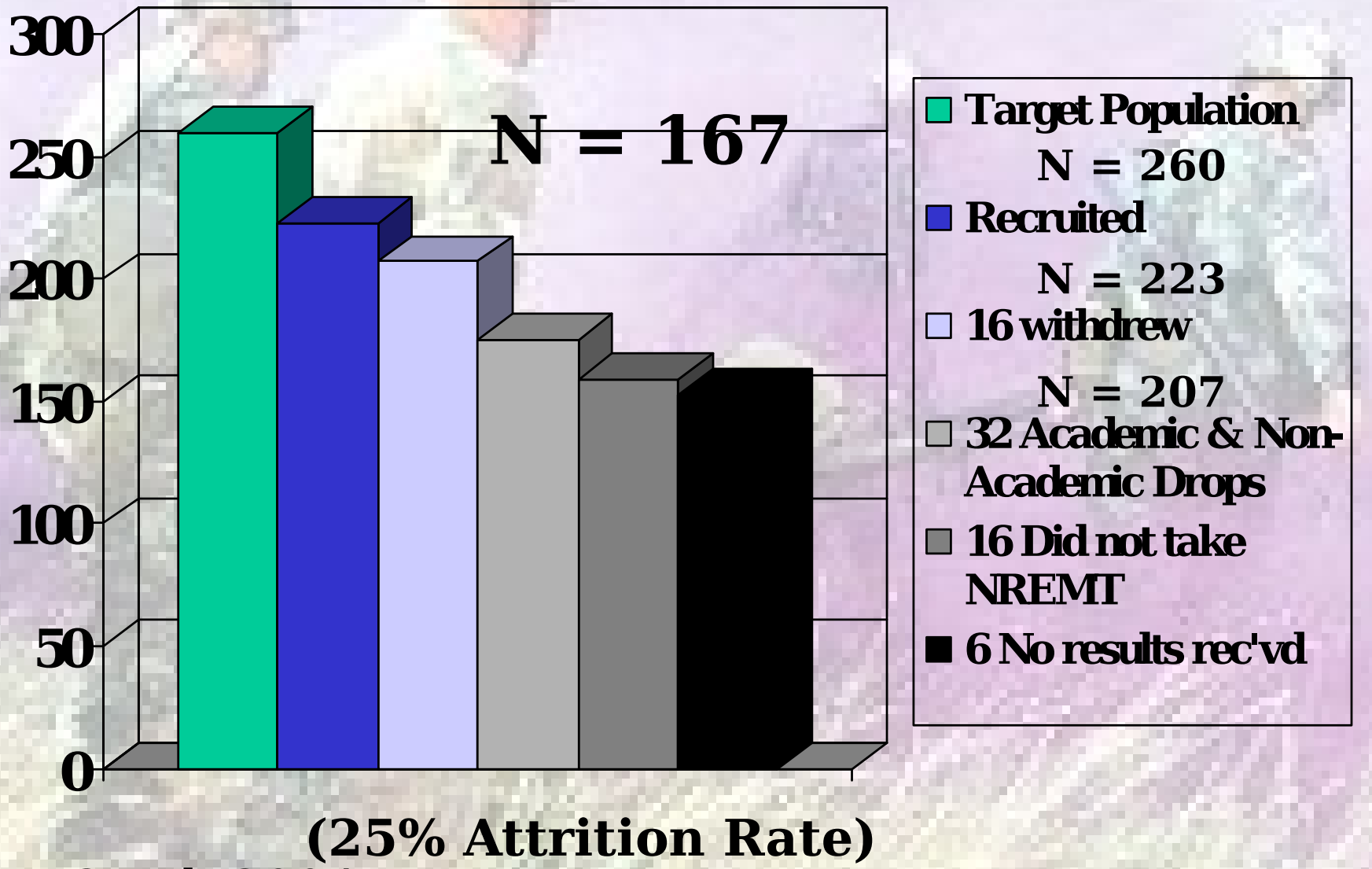
Innovative Practice of Emergency Care

Study Design

- **Six scheduled EMT-Classes at JMTC**
  15 July 02 – 23 May 03
- **STATCare randomized to 3/6 classes**
- **Access during skills sessions**
- **Student Volunteers**
- **NREMT Scores**
- **Minutes of use computer tracked**
- **Demographics**
- **LTSI**



Sample



(25% Attrition Rate)

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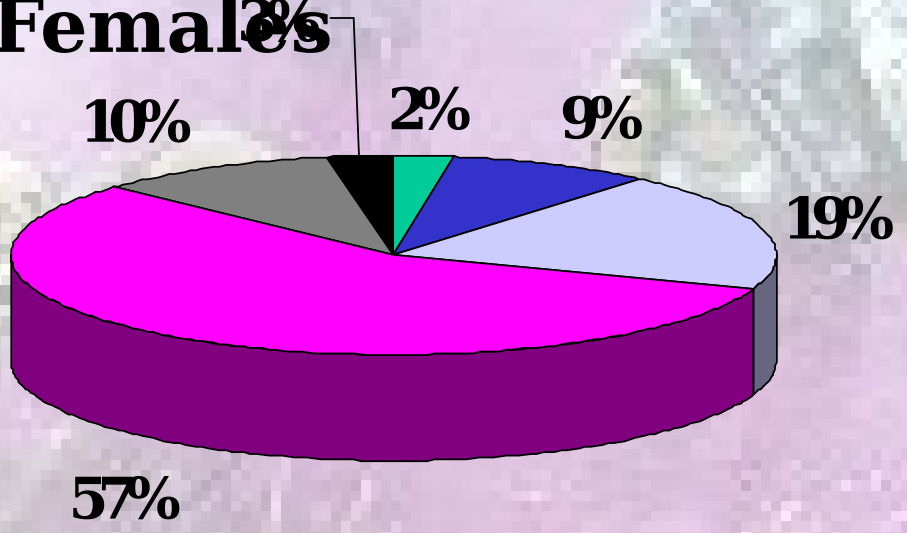
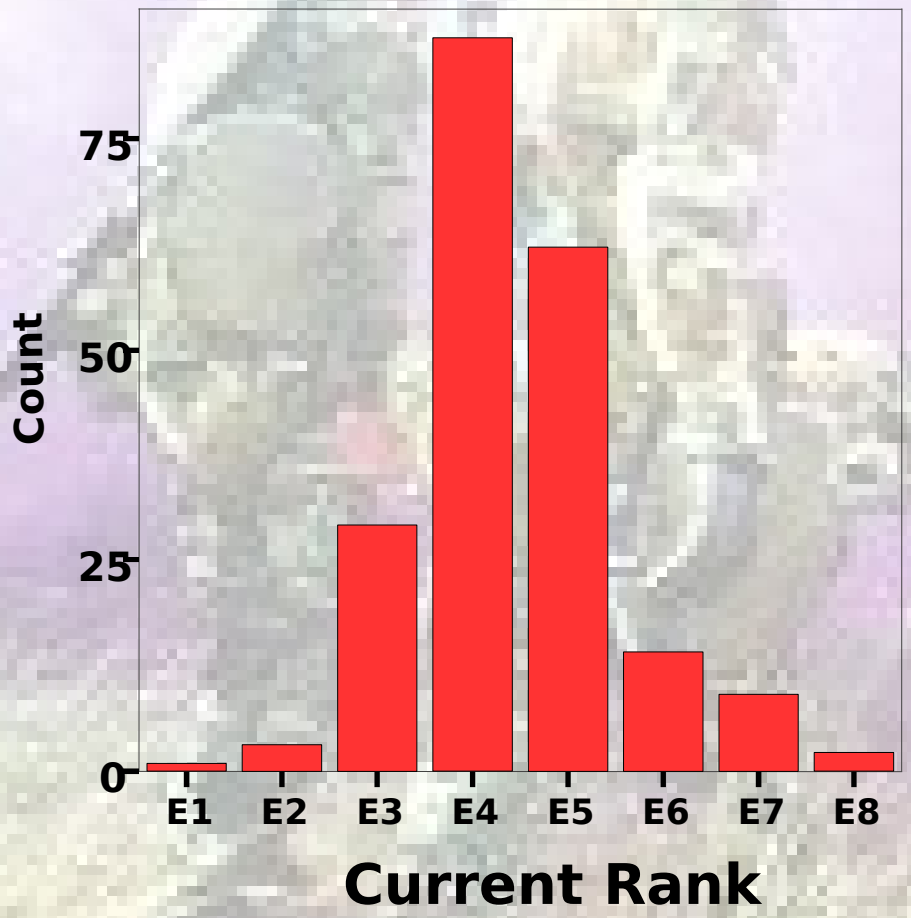
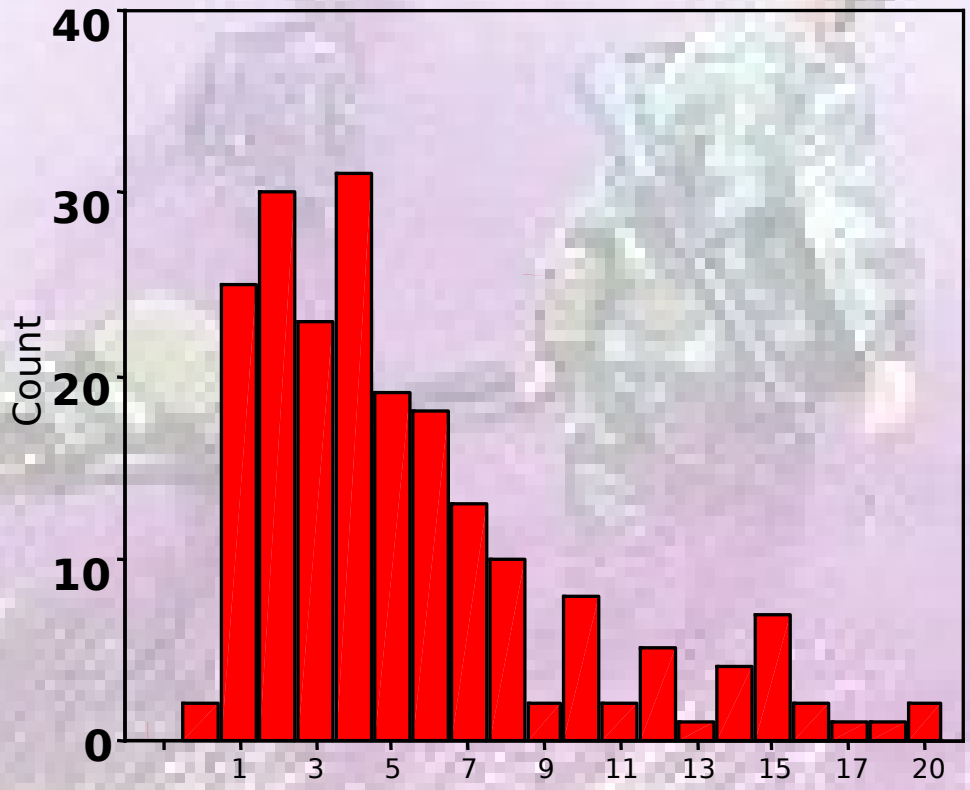
Sample Characteristics

- Average Age 27 (6.38)
- 76% Males; 24% Females
- Ethnicity



Sample Characteristics





N=207

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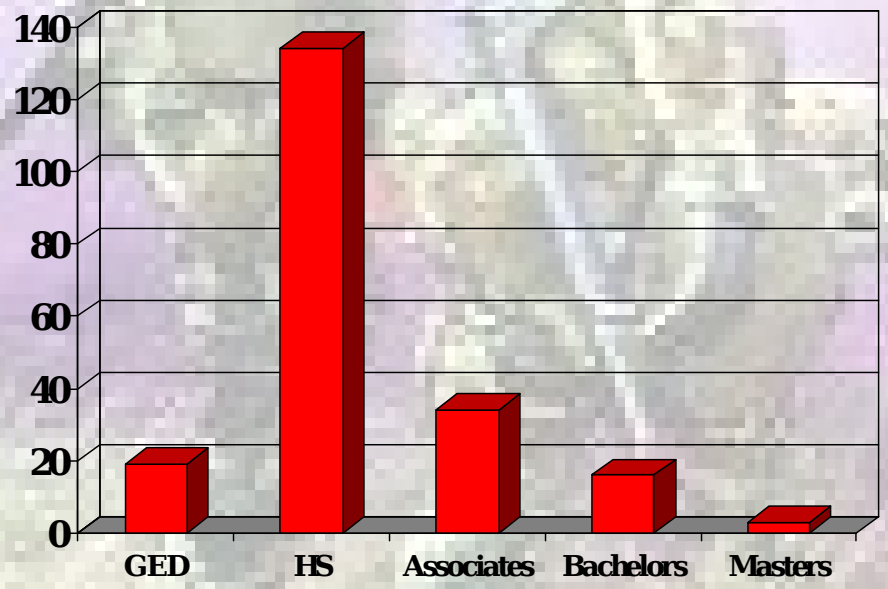
Educational Characteristics

Highest Educational Level



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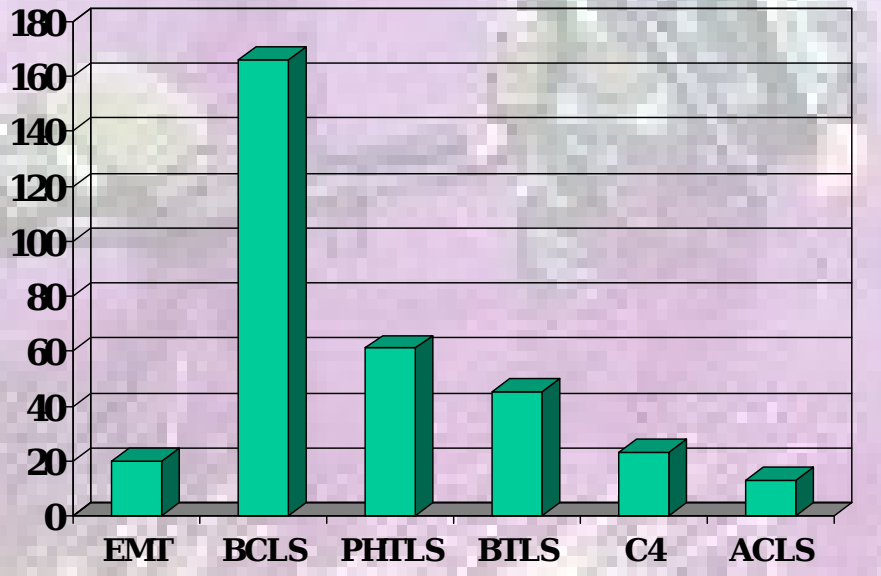

Other Certifications

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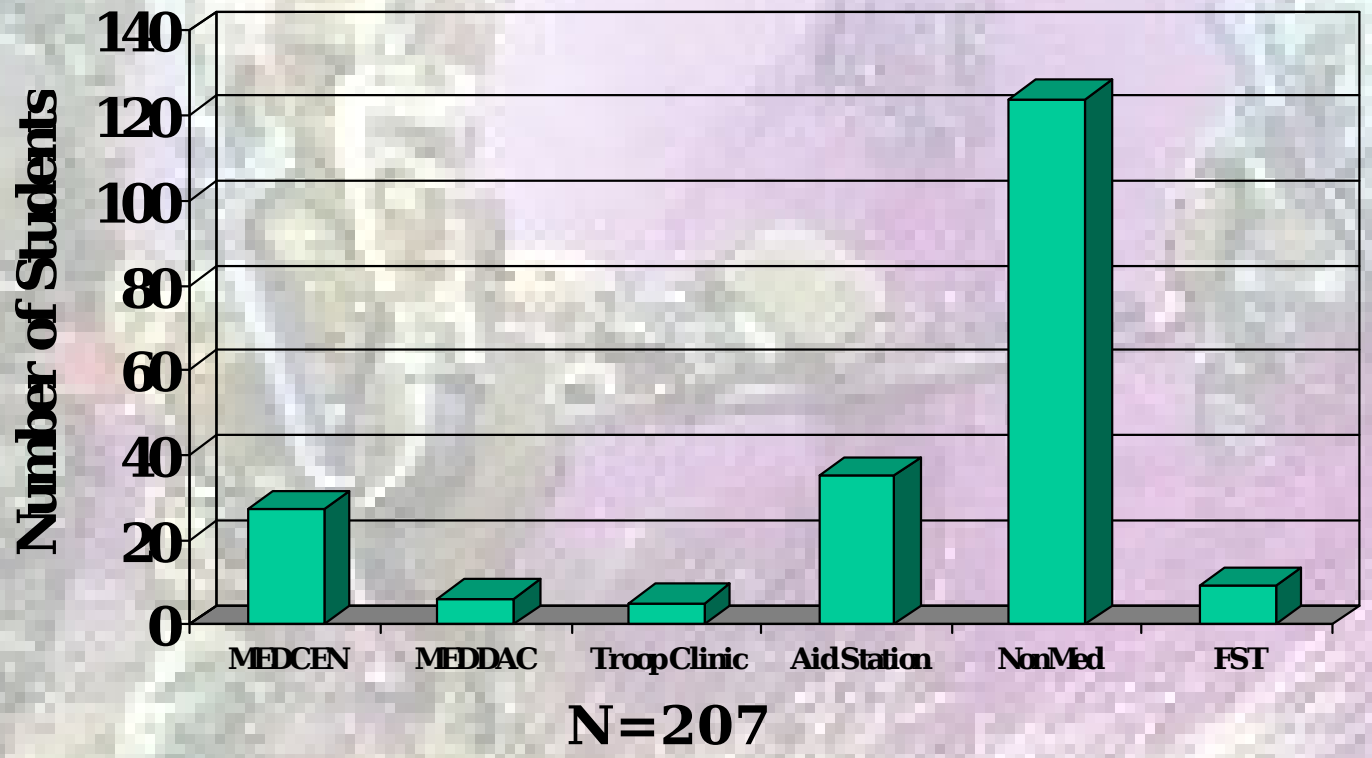
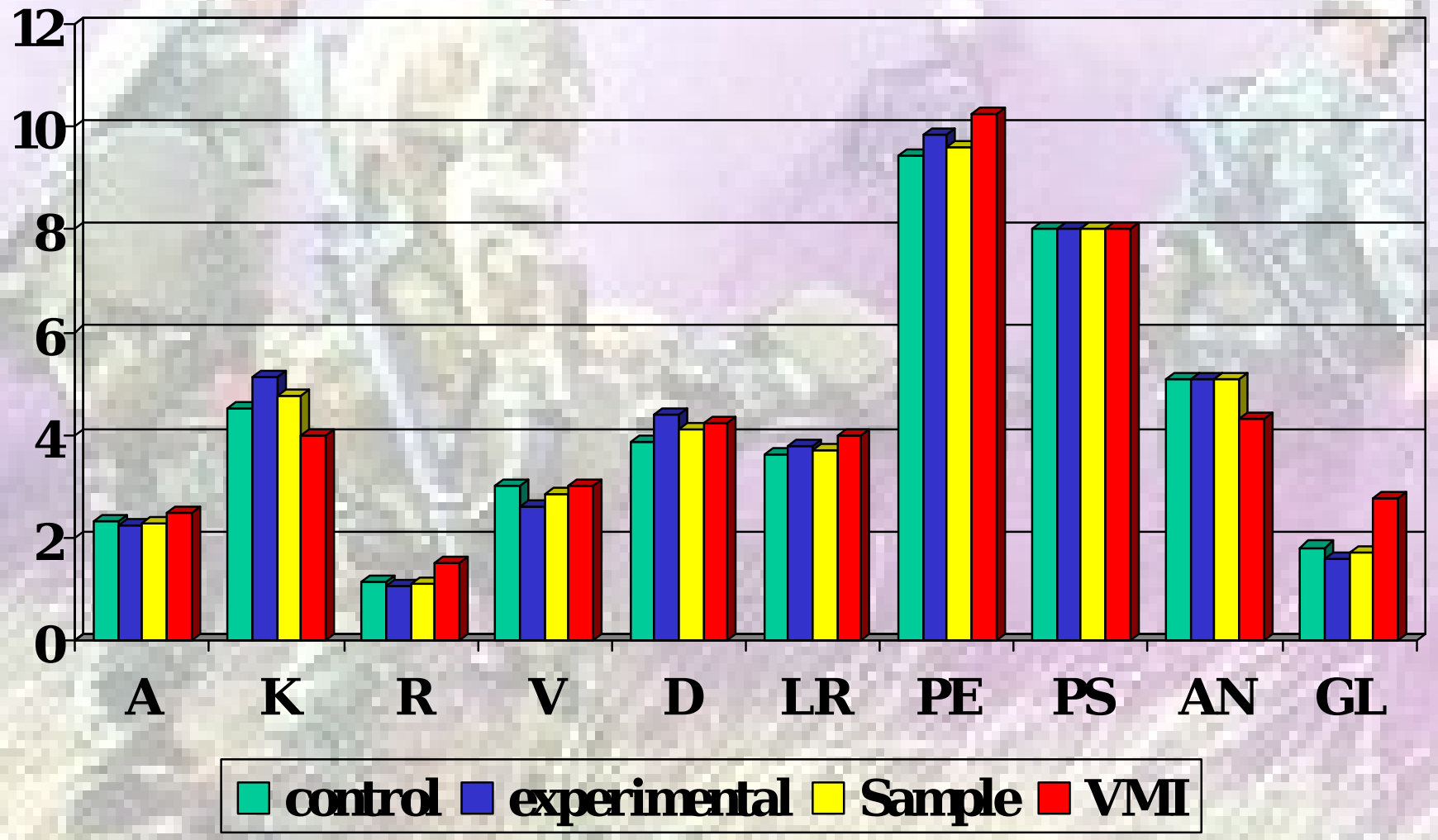
Work Characteristics

Current Unit of Assignment



- Average number of hours/week directly touch patients

LTSI Student Profiles



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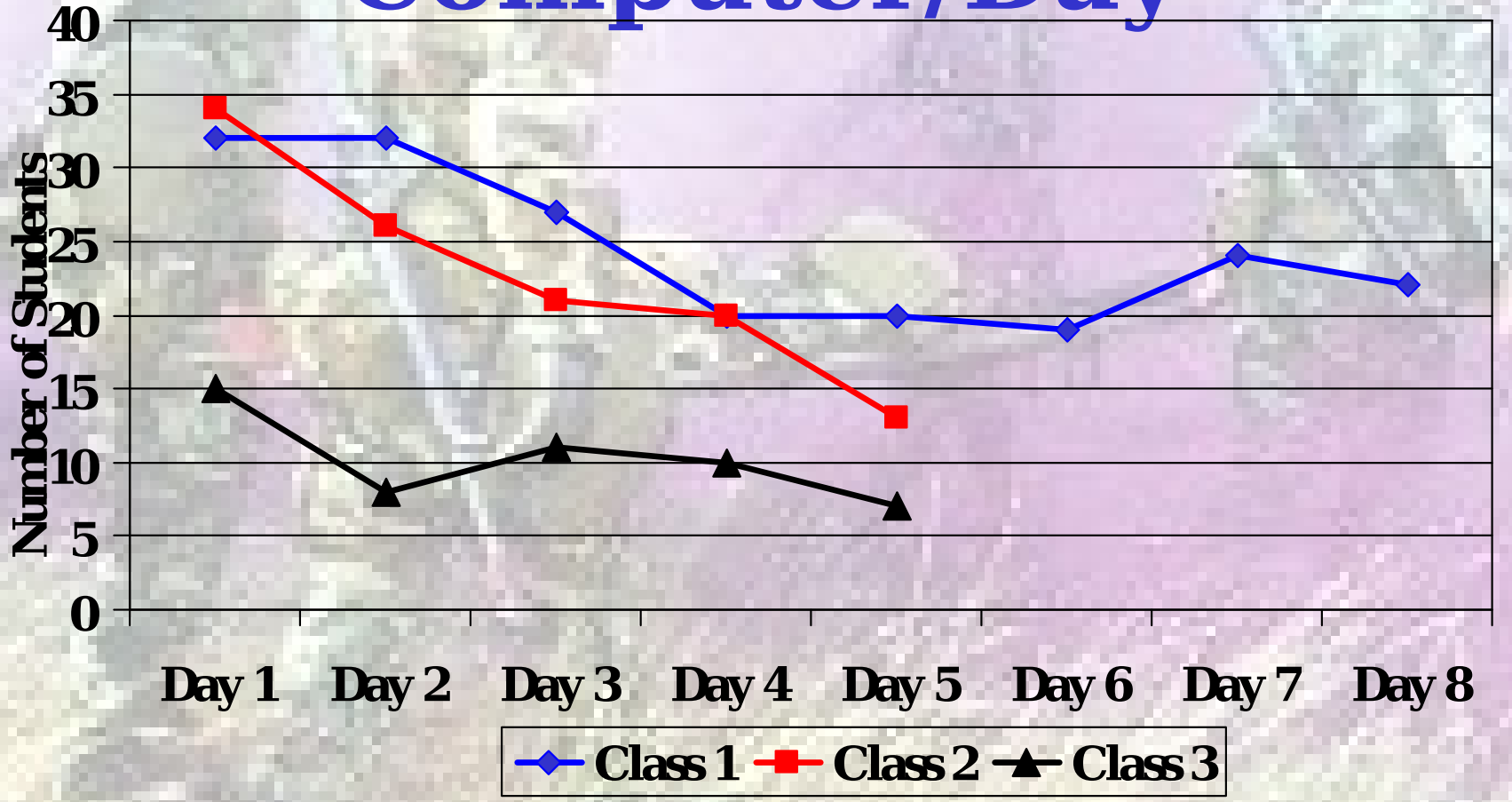
Number of Students Using the Computer/Day



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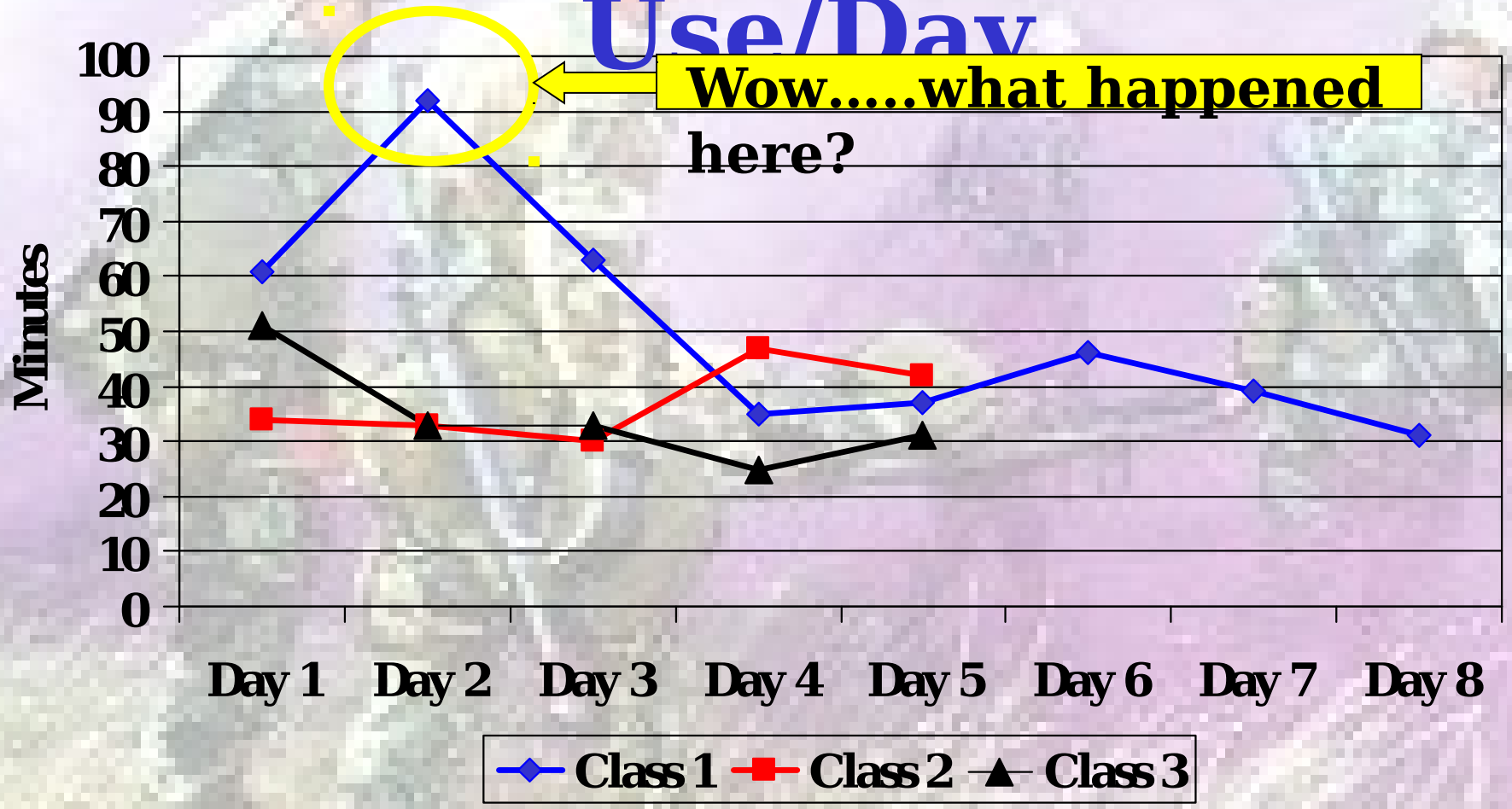
Average Computer Use/Day



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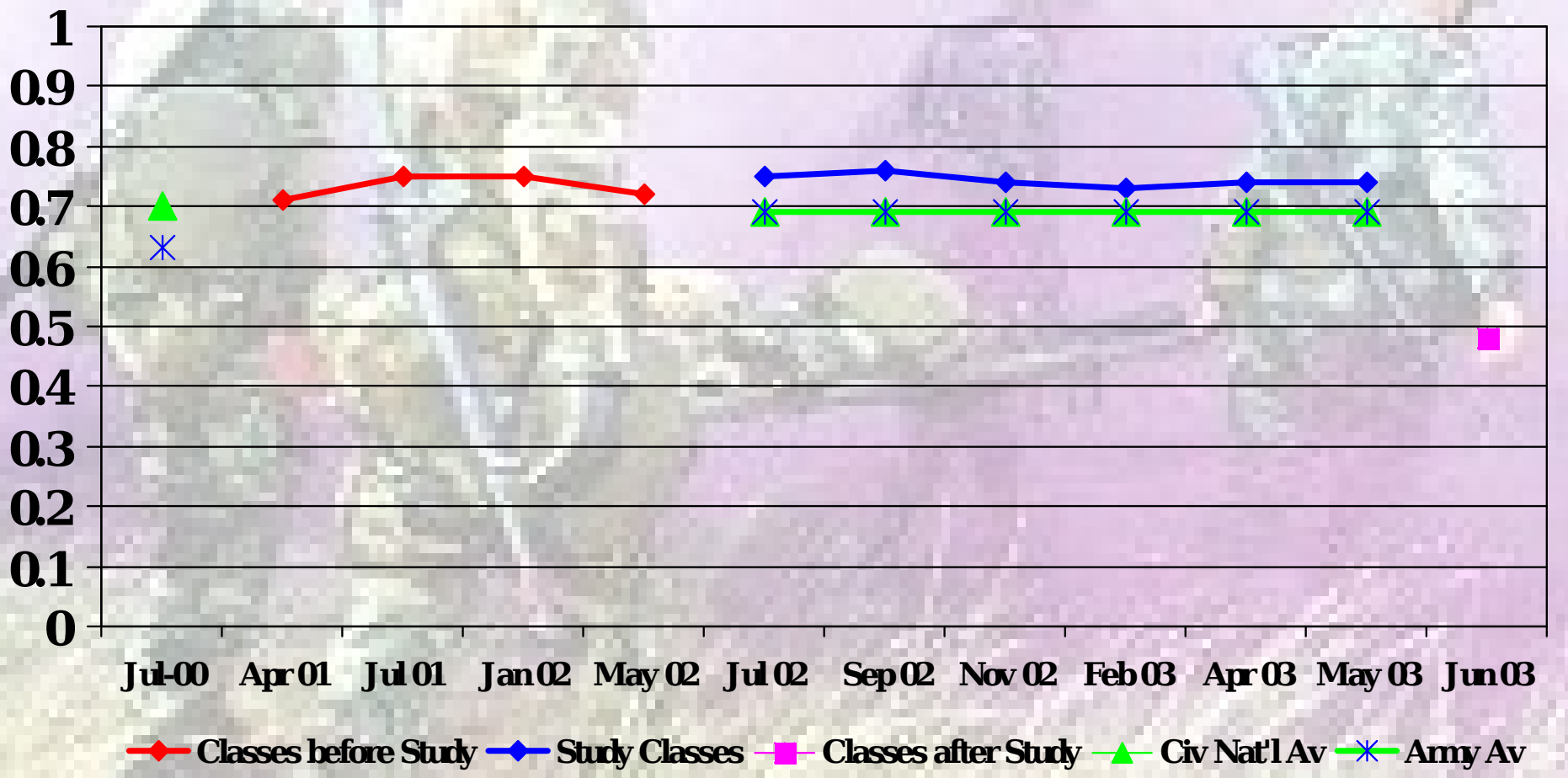
NREMT Average Pass Rates



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Results

- **No significant difference in test scores ($t = 1.019$, $df = 153$, $p = 0.745$, one-tailed)**
- **No significant difference in pass rates ($\chi^2 = 1.575$, $df = 1$, $p = 0.209$)**
- **No relationship between drop-out status and group status (experimental vs. control)**
- **No difference in cost benefit analysis**

Results

- **Understanding variables that are most closely related to actual exam Scores and probability of passing NREMT**
- **Predicting Exam Scores**
  - **Student success in course**
  - **Readiness to take the exam**
- **Predicting the probability of passing**
  - **Student success in course**
  - **Readiness to take the exam**

Variables Related to Actual Exam Scores

(Screening for Student Success prior to EMT C

Variable	Correlation	p-value
Age	0.202	0.012
Rank	0.298	<
Years in current MOS	0.303	0.001
*Years in MEDCEN	0.316	0.001
Currently assigned to TOE unit	0.189	0.019
*Number of tours in TOE unit	0.333	0.034
*# of hrs in direct pt care in non-med unit	-	0.088
Currently have other certification	0.207	0.036
Past BCLS certification	-0.270	0.003
Past ACLS certification	0.267	0.001
Past BTLS certification	0.169	0.037
Past EMT certification	0.312	<
Self-assess of EMT knowledge	0.202	0.013
Self-assessment of EMT skills	0.159	0.053
LTSI auditory	0.157	0.050
LTSI kinesthetic	-	0.030
LTSI distractibility	0.174	0.051
LTSI logical	0.135	0.093
JMTCEMT pre-test	0.430	<
Total hours in patient care	0.155	0.004

Building the Model to Predict Exam Scores

(Screening for Student Success Prior to EMT C

Multiple Regression Analysis Using Backward El

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
	B	Std. Erro	Beta			Lower Bound	Upper Bound
(Constant)	56.831	2.717		20.917	.000	51.462	62.200
Current Rank	1.161	.425	.200	2.729	.007	.320	2.001
have had ACLS certification in the past	2.793	1.248	.164	2.238	.027	.327	5.259
JTCEMT pretest	.199	.035	.402	5.731	.000	.131	.268

a. Dependent Variable: National Registry EMT Percent pass score

Note: Variables p>.05 were removed

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Predicting NREMT Scores

(Formula for Screening Student for Success Prior to taking

EMT Score = 56.831
+1.61 (current rank)
+2.703 (Past ACLS Certification)
+0.199 (Pre-test)

73.08% = 56.831 + 1.61 (2)
+2.703 (0) +0.199 (70)

84.5% = 56.831 + 1.61 (6)
+2.703 (1) +0.199 (90)

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Level of Predictive Ability

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1519.10	3	506.368	19.128	.000[a]
	Residual	3944.424	149	26.473		
	Total	5463.52	152			

a. Predictors: (Constant), JMTCEMT pretest, Current Rank, have had ACLS certification in the past

b. Dependent Variable: National Registry EMT Percent pass score

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.527[a]	.278	.264	5.15

a. Predictors: (Constant), JMTCEMT pretest, Current Rank, have had ACLS certification in the past

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Variables Related to Actual Exam Scores

(Counseling on Readiness to Take the NREM

Variable	Correlation	p-value
Quiz #1	0.488	< 0.001
Quiz #2	0.358	< 0.001
Quiz #3	0.282	< 0.001
Mid-term	0.580	< 0.001
Quiz #4	0.358	< 0.001
Quiz #5	0.498	< 0.001
Quiz #6	0.409	< 0.001
Quiz #7	0.467	< 0.001
Final exam	0.326	< 0.001

Building the Model to Predict Exam Scores

(Readiness to Take the NREMT)

Multiple Regression Analysis Using Backward Elim

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Erro	Beta			Lower Bound	Upper Bound
1	quiz scores #1	.126	.052	.146	2.406	.017	.023	.229
	quiz scores #3	.9209	.041	.102	2.232	.027	.011	.174
	midterm scores	.285	.056	.288	5.093	.000	.175	.396
	quiz scores #5	.	.061	.266	3.715	.000	.105	.344
	quiz scores #7	.178	.048	.199	3.696	.000	.083	.273

a. Dependent Variable: National Registry EMT Percent pass score
b. Linear Regression through the Origin

Note: Variables p>.05 were removed

- Quiz 1 (preparatory)
- Quiz 3 (pt assessment)
- Quiz 5 (trauma assessment)
- Quiz 7 (operations)

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Predicting NREMT Score

(Readiness to Take the NREMT)

EMT Score = .126(Quiz #1) + .9209(Quiz #3) +.285(Midterm) +.225(Quiz #5) + .178(Quiz #7)

72.49% = + .126(80) +.9209(80) +.285(80) + .178(80)

54.37% = + .126(60) +.9209(60) +.285(60) + .178(60)

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Level of Predictive Ability

ANOVA[d]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	861889.	5	172377.8	9634.94	.000[a]
	Residual	2683.636	150	17.891		
	Total	864573.[b]	155			

Model Summary

Model	R	R Square[a]	Adjusted R Square	Std. Error of the Estimate
1	.998[b]	.997	.997	4.23

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Results

- **Understanding variables that are most closely related to actual exam Scores and probability of passing NREMT**
- **Predicting Exam Scores**
  - **Student success in course**
  - **Readiness to take the exam**
- **Predicting the probability of passing**
  - **Student success in course**
  - **Readiness to take the exam**

Variables Related to Probability of Passing NREMT

Variable	G	df	p-value
Primary ethnic background (race)	9.9	5	0.07
Years in current MOS (yrmos)	2.8	1	0.09
Hours in direct patient care	3.6	1	0.05
*Hours in patient care in MEDCEN unit	4.9	1	0.02
*Hours of duty in TOE unit	10.86	1	0.00
Have had ACLS certification in the past	3.797	1	0.05
Have had EMT certification in the past	4.7	1	0.02
LTSI Kinesthetic	6.2	1	0.01
LTSI Reading	4.8	1	0.02
LTSI Distractibility	4.6	1	0.03
JMTCEMT pretest	12.162	1	< 0.001
Quiz #1	22.446	1	< 0.001
Quiz #2	12.531	1	< 0.001
Quiz #3	11.050	1	0.00
Mid-term	24.52	1	< 0.001
Quiz #4	11.298	1	0.00
Quiz #5	12.429	1	< 0.001
Quiz #6	4.3	1	0.03
Quiz #7	16.392	1	< 0.001
Final exam	3.146	1	0.07

Variables in the Equation

Student Success in the Course

	B	S.E.	Wald	df	Sig.	Exp(B)	90.0% C.I.for EXP(Lower	Upper
RACE2			8.692	2	.013			
RACE2(1)	-1.585	.543	8.512	1	.004	.205	.084	.501
RACE2(2)	-.620	.466	1.768	1	.184	.538	.250	1.158
Direct Pt Care Hrs	.042	.020	4.447	1	.035	1.043	1.009	1.077
Distractibility	-.197	.081	5.981	1	.014	.821	.719	.938
PRETEST	.036	.007	24.463	1	.000	1.037	1.025	1.050

a. Variable(s) entered on step 1: RACE2, DIRECTHR, DISTRACT, PRETEST.

Model Discriminatory Ability

Student Success in Class[a]

Observed		Predicted		
		NREMT Results		Percentage Correct
		Fail	Pass	
pass or fail NREMT?	Fail	20	17	54.1
	Pass	20	97	82.9
Overall Percentage				76.0

a. The cut value is .680 Marginal acceptable discrimination
Note: Values between .80-.90 are considered excellent for discriminator

Hosmer and Lemeshow Test

	Chi-squa	df	Sig.
	5.651	8	.686

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Variables in the Equation

Readiness to take the NREMT

	B	S.E.	Wald	df	Sig.	Exp(B)	90.0% C.I.for EXP(B)	
							Lower	Upper
QUIZ1	.075	.032	5.441	1	.020	1.078	1.022	1.136
QUIZ3	.064	.028	5.064	1	.024	1.066	1.017	1.117
MIDTERM	.113	.039	8.382	1	.004	1.120	1.050	1.194
QUIZ7	.074	.032	5.377	1	.020	1.077	1.022	1.135
Constant	-24.67(	4.997	24.382	1	.000	.000		

a. Variable(s) entered on step 1: QUIZ1, QUIZ3, MIDTERM, QUIZ7.

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Model Discriminatory Ability

Readiness to take the NREMT

Observed		Predicted		
		pass or fail NREMT?		Percentage Correct
		Fail	Pass	
pass or fail NREMT?	Fail	28	10	73.7
	Pass	19	98	83.8
Overall Percentage				81.3

a. The cut value is .650 - an acceptable discrimination

Hosmer and Lemeshow Test

	Chi-square	df	Sig.
	5.159	8	.740

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Cost Benefit

		Average Cost	Benefit Cost
All Students		$795.29	
Control Group	Passed exam	$801.81	1.0108
	All Students	$793.24	
STATCare Group	Passed exam	$816.15	1.0224
	All Students	$798.26	

The benefit/cost is calculated for each group by taking the average cost of the passing students in that group divided by the average cost for all students in that group. One can see that the benefit/cost ratios are quite similar between the two groups.

Please enter information in the yellow highlighted areas.

Note: Only the yellow cells may be modified. Text entries in these cells are case sensitive.

Pre-course Information

Current Rank (numeric only)	5
Past ACLS Certification (Yes or No)	Yes
Race (White, Black, or Other)	Other
Direct Hours of Patient Care per Week	30
LTSI Distractibility Score	5
LTSI Auditory Score	1
LTSI Logical Score	2
JMTCEMT Pretest Score	90

Pre-course Predictions

Predicted EMT Exam Score
83.3

Probability of Passing EMT Exam
83.7%
Is Likely to Pass

Probability of Dropping out of Course
11.3%
Not Likely to Drop Out

Post-course Information

Quiz #1	80
Quiz #3	80
Mid-term	80
Quiz #5	80
Quiz #7	80

Post-course Predictions

Predicted EMT Exam Score
72.5

Probability of Passing EMT Exam
80.3%
Is Likely to Pass

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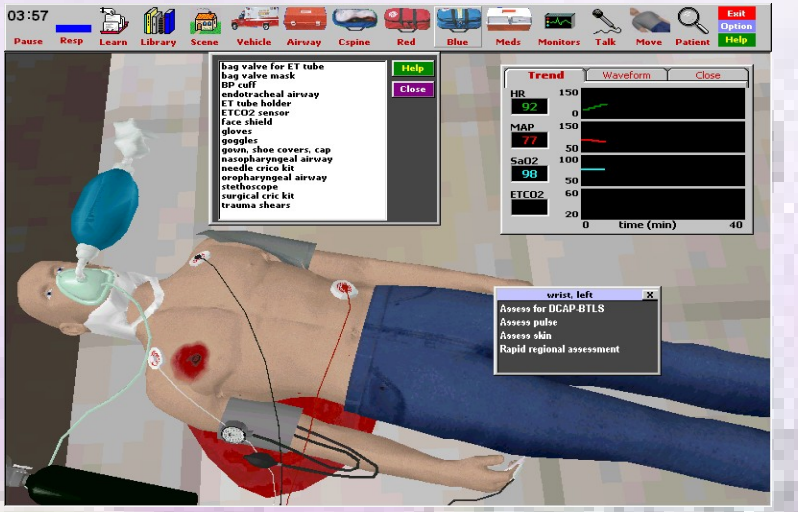
Limitations & Lessons Learne

Before……



& After ……

17 iterations of software……

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Conclusions

- **No Significant difference in NREMT scores when the curriculum is augmented with STATCare**
- **Large confounding variable of numerous software iterations**
- **Beginning Model for initial screening and counseling can be used as one of leadership's tools for student selection and student counseling.**

Implications

- **Changing Software/Commercial Buy**
- **Learning Feedback/Educator Input**
- **Student Satisfaction with software**
- **Duplicate Study with Final Software Product**
- **Multi site Studies to Refine the Models of Prediction**

Questions?

This research was sponsored by the Telemedicine and Advanced Technology Research Center (TATRC), US Army Medical Research and Materiel Command (MRMC); however, the information or content and conclusions do not necessarily represent the official position or policy of, nor should any official endorsement be inferred by, Madigan Army Medical Center, the Department of Defense, or the U.S. Government.

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